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Recognition of the Image by Using Plant Diseases Ontology in Image Processing

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Abstract: Plant disease is condition caused by infectious organisms or environmental factor. Plant plays a very decisive role in the ecological balance and is a prerequisite to life. There are various environmental factors that have cause various plant diseases beside the diseases caused due to infection causing micro-organisms. Hence there is an urgency to determine the disease for the betterment of agriculture. In this paper, image segmentation, feature extraction, PCA (Principal Component Analysis) and adaptive K-means clustering have been examined for the identification of heterogeneous plant diseases.

Keywords: Image Segmentation, Thresholding, Noise reduction, Binarization, Plant Recognition On the basis of Shape, Feature extraction phase for image recognition for Plant Diseases.

I. INTRODUCTION

India is an agricultural country where about 70% of the population depends on agriculture [1]. Plants perform a very persuasive role in the life; they cannot only contribute the daily requirements such as food, medicine and industry crop, but also play an inevitable role in the ecological balance. Hence, it is essential to perceive and protect the diversity of plants. Plant diseases caused by plague, fungi, viruses, bacteria etc. These diseases occur frequently and their symptoms differ from each other. Damage done by insects is one of the major trait faced by the crops. Since, insecticides may be pernicious to some of the birds. So, these are not always profitable and hence act as a major agent that bruises the natural food chain. There are a diversity of plant diseases in the world which can infect other areas of the tree like twigs, leaves, and branches. Sometimes, it leads to complete harvest loss and even enforce food scarcity. The ability of disease diagnosis in early stages is very essential so that timely cure and control of such diseases leads to decrease in production of dissatisfactory products. Plant disease recognition based on image processing could quickly and accurately provide useful information for the prediction and control of plant diseases. The diseases may be of any type like wheat diseases, leaf diseases etc [2].Various aspects for plant diseases recognition are discussed below.

Image Segmentation:

Image segmentation is not just the essential alteration of image transforming and prophase vision, the imperative segment of an image, but its investigation and visual framework. Image segmentation divides the image such that there must be distinctive areas with uncommon importance in the image. These distinctive areas do not overlap one another, and each area must meet consistency conditions in particular areas.

Thresholding

A gray scale or colour image is reduced to a binary image. Binarization of document images is done by a well known technique known as Thresholding. Thresholding is further branched into two types that is the global and local thresholding technique.

Noise reduction:

Disconnected line segments, bumps and gaps in lines, filled loops etc are caused by the noise introduced by the optical scanning device or the writing instrument. Local variations, rounding of corners, dilation and erosion is a sort of distortion which leads to problems. It is essential to eliminate these imperfections, prior to the character recognition.

Binarization:

Binarization is of enormous emphasis in the document image analysis and recognition pipeline since it affects further stages of the recognition process. It helps in checking the adequacy of an assessment of a binarization strategy.

Plant Recognition On the basis of Shape:

Shape is an important aspect in recognizing plants. Plants can be identified on the basis of combination of geometric features such as aspect ratio, compactness, and dispersion, or moments such as moment invariants. In pattern recognition and images retrieval, besides color and textures, shape is one of the important aspects used to characterize objects. Actually, various approaches have been incorporated in object recognition or images retrieval.

***Feature extraction phase for image recognition for Plant Diseases*:**

For feature extraction, there are numerous methods according to the diversity of colour, texture, and shape of crop diseases image. It is observed that the wheat diseases generally have infected spots which are easy to segment and analyse. So, the regions consisting of infected spots are

extracted from the leaf and then the low-level features such as colour, texture and shape are extracted from the image.

II. RELATED WORK

Zhaobin Wang et al. (2014) proposed a novel method of plant recognition based on leaf image. In this proposed work both shape and texture features were employed. The author used the concept of Texture feature which was extracted by intersecting cortical model. Further shape feature was obtained by using the center distance sequence. Moreover, the classifier was employed as the Support vector machine. In the proposed algorithm, firstly the image of leaf was pre-processed in order to get better quality for extracting features, and then the next step is to find the entropy sequence and center distance sequence by intersecting cortical model and center distance transform, respectively. Redundant data of entropy sequence vector and center distance were reduced by principal component analysis[3]. After that, feature vector was used for the classification and imported as the classifier. Finally, it was concluded that their method gives better accuracy of recognition than other methods.

Petr Novak et al. (2013) gives the knowledge about enabled querying and inferring which gives the solution for supporting the efficient integration of diverse engineering tools, such as simulators and SCADA(supervisory control and data acquisition) systems. The proposed approach support reasoning techniques and efficient utilization of domain specific languages and could be used for both discrete and continuous systems, especially the large-scale ones. A practical example, describing a passive house with ontology individuals and generating the structure of a simulation model automatically by the implemented tool, is involved in this work [4].

Zulkifli Bin Husin et al. (2012) introduced a technique for feasibility study on Plant Chili disease detection using Image Processing Techniques. This paper examines leaf feature inspection, which is an effective way in early detection of chili disease. At initial stage, the health status of each plant was determined by capturing and processing the leaf image. After that, the chemicals were applied to the plants periodically such that the chemicals were only applied when the plants were considered to be effected by the diseases. Furthermore, hundreds of chili disease images were used to perform image processing. The plant chili disease detection through leaf image and data processing techniques was an effective and inexpensive system, especially for assisting farmers in monitoring the big plantation area [5]. As a conclusion, this work strongly recommends the leaf inspection to be done for early detection of plant chili disease.

Song Kai et al. (2011) proposed a technique for maize disease image recognition which is based on image processing and analysis. Corn diseases used YCbCr color space technology to divide the disease spot, according to the texture characteristics. After that the co-occurrence matrix spatial gray level layer was used to extract the disease spot texture and BP(Backward propagation) neural network to classify the maize disease. The application of YCbCr color space technology segmented disease spot, and used the co-occurrence matrix spatial gray level layer and extracted disease spot texture feature by using BP neural network for maize disease classification and identification[6]. The experimental results showed that the algorithm can effectively analyze the disease image and the accuracy was as high as 98%, the study provided the theoretical basis to cognition of maize leaf disease.

Hong QI et al. (2010) developed the corn plant ontology by using Formal Concept Analysis based approach which used the concept of lattice by building it from terminology-file relationship table. The author proposed a method based on the corn plant ontology, in which the syntactic parser generated the RDF(Resource description framework) triples and the weight calculation was done by feature words which were selected by an improved method. In comparative experiment one hundred documents were selected as the dataset, and the result showed that the semantic retrieval system introduced in this paper was superior to keyword-based retrieval method in precision ratio and recall ratio [7].

III. PROPOSED WORK

In the proposed method, an advanced approach to identify and recognize the plants on the basis of segmentation and feature extraction process to find their diseases, symptoms and cures is used. PCA (Principal Component Analysis) with adaptive k-means cluster and segmentation has been used to extract and recognize the plants and their features. Finally, the performance evaluation shows that the result is encouraging and the recognition of plant diseases, symptoms and cures are determined on various features of plants.

Proposed Strategy

1. Development of a representative dataset for the plant disease images.
2. Study on various plant diseases.
3. Generate and maintain the dataset for the information of particular images for finding the type of disease, its symptoms and cure.
4. Perform feature extraction on the basis of texture, to analyse and recognise the image from the dataset.
5. PCA with adaptive k-means cluster are used to extract and recognise the plants and their features.
6. Analyze the results and performance with respect to input images for metrics like PSNR(Peak signal to Noise ratio) which is used to measure the quality of reconstructed images that have been compressed and RMSE (Root mean square error) which is used as a measure of the differences between values predicted by

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a model or an estimator and the values actually observed .

Implementation

The implementation steps include the following:

1. Image Acquisition: Firstly, image acquisition is performed in which image is retrieved from some source.
2. Image Pre-processing: The image is pre-processed by performing image smoothing, image enhancement and edge detection.
    - Image Segmentation: It comes under Image Pre-Processing. Image segmentation is to separate the different regions in the image with special significance. These regions do not intersect each other, and each region should meet consistency conditions in specific regions. The

      segmentation of images is done on the basis of texture such that the spots in the plants should be separated in a proper way. If any background information is present in the plant diseases image, this background is removed.
3. Image Extraction: Feature Extraction is a sub component of image extraction.
    - Feature Extraction: Feature extraction is an important step for plant recognition. There is lot of sequence required for plant recognition like entropy sequence, center distance sequence etc. Firstly, the regions of infected spots are extracted from the leaf and then the low-level features such as colour, texture and shape are extracted from the image.
4. Image Classification: Image is classified with the help of PCA(Principal Component Analysis). The main purpose of a principal component analysis is to analyze data for identifying and finding patterns to reduce the dimensions of the dataset with minimal loss of information.
5. Adaptive K-means Clustering Algorithm: The proposed adaptive K-mean clustering algorithm is capable of performing the segmentation of the regions where smoothly varying intensity distributions are present. The modelling of the regions leads to spatial constraints that are incorporated in the clustering algorithm. Knowledge-based morphological operations are applied after that to the segmented regions in order to analyze the desired regions according to a prior anatomical knowledge of the region-of interest.

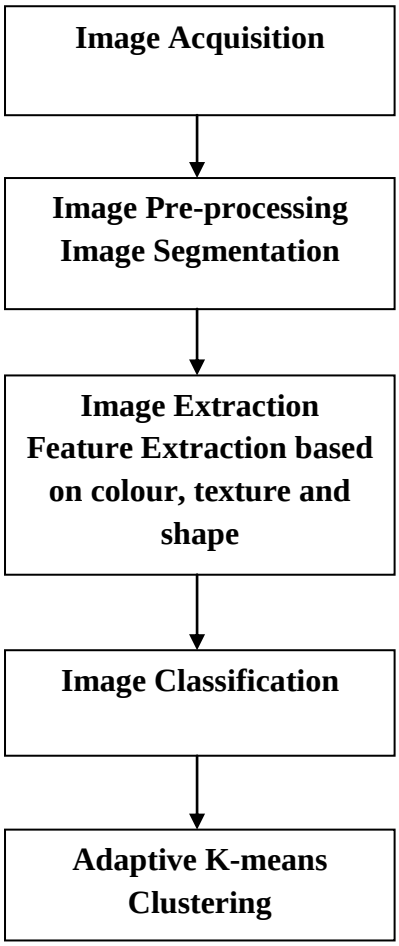

Figure 1. Implementation steps

IV. RESULTS AND DISCUSSION

The results show the various images that have come forward from the feature extraction, image segmentation, PCA and adaptive k-means clustering. The disease name found from the input image has also been show. PSNR and RMSE are two parameters which have been used in measuring the performance of input images. MATLAB has been used as the experimental tool

for measuring features, and analyzing shapes and textures, visualization, and algorithm development.

Figure 2: Input Image

Figure II depicts which input image has been selected from all the data sets of plant diseases. This is the initial and basic

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need of the project in which examination of the selected image has to be performed.

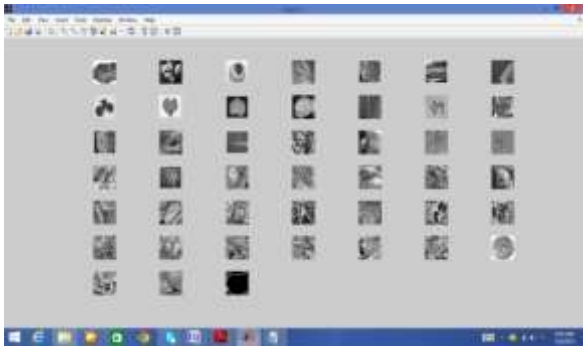

Figure 3: Procedure of PCA

Figure III clearly depicts the procedure of Principal Component Analysis in which all the images are extracted and converted into gray scale and one selected image is considered for further procedure. These images are displayed just after choosing the input image.

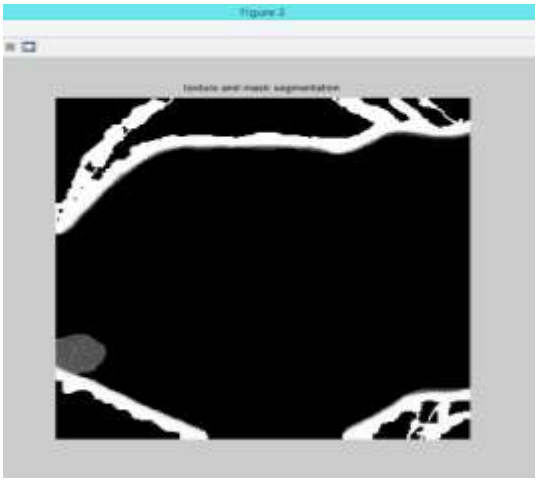

Figure 4: Image of texture and mask segmentation

In this phase, the texture and mask segmented image of the input image is displayed. This is the part of pre processing phase in which the segmentation of the input image has to be carried out. Figure III clearly depicts the texture and mask segmentation process.

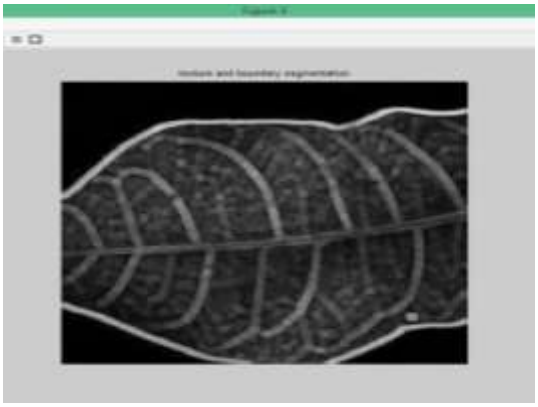

Figure 5: Image of texture and boundary segmentation

Figure V depicts the boundary and texture segmentation of input image. To execute the proposed algorithm calculation of texture and boundary segmentation are required.

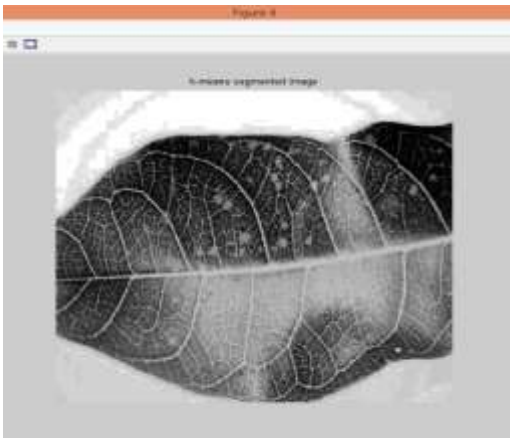

Figure 6. Image of K-means segmentation

Figure VI depicts the effect of K-means segmented image. Here, K-means segmentation is used and applied for the input image.

Figure 7: Image of K-means cluster formation

Adaptive K-means cluster formation after segmentation have been applied. The figure VII depicts the effect of K-means cluster formation for the input image.

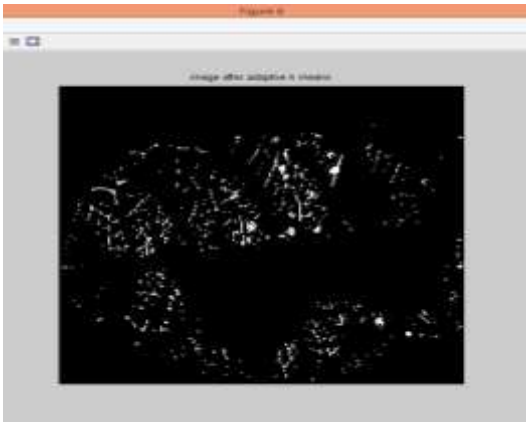

Figure 8: Image after adaptive K-means

Figure VIII depicts the effect of adaptive K-means which is further used for feature extraction process. This helps in recognition of the input image. It forms spores and K-means features of the input image.

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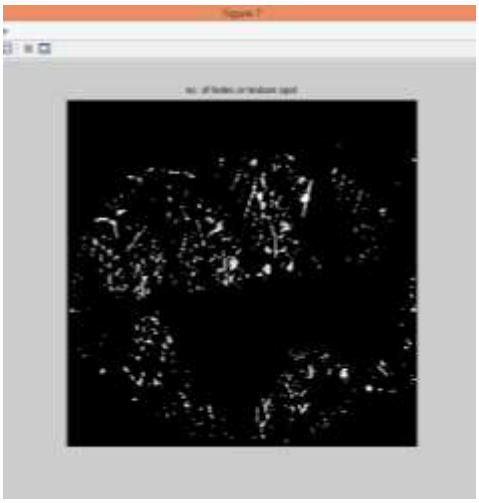

Figure 9: Image of the no. of holes or texture spot of input image

Figure IX depicts the effect of plant disease image in the form of texture spot or no. of holes which were found after segmentation, k means cluster and feature extraction.

Figure 10: Recognition of input image

After applying all the requisite procedure and feature extraction on the basis of the proposed algorithm, the plant diseases are found and the input image is also recognized for which the entire process has been performed. Figure X depicts the recognition of input image and the plant disease for the selected image.

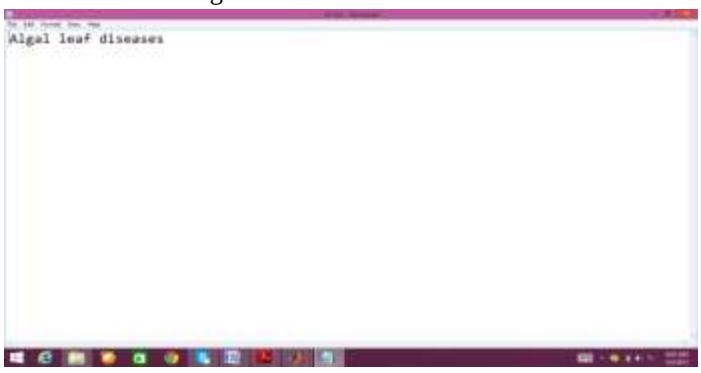

Figure 11: Plant disease name found for the input image

After carrying out all the procedure of the proposed work and as per objectives, the name of the plant disease is stored in a fact file.

V. CONCLUSION AND FUTURE SCOPE

This paper presents an approach with the help of which plant diseases can be recognised. The proposed work helps in recognising the plant diseases and finding out their associated information such as plant diseases name, its symptoms and cures. The approach consists of using PCA (Principal Component Analysis), Image segmentation, Feature Extraction and Adaptive K-means cluster formation technique. Performance parameters PSNR (Peak signal to Noise ratio) and RMSE (Root mean square error) will be used for comparison of the images in the dataset in future work. Symptoms of the diseases and its cure along with performance metrics PSNR and RMSE will be carried out in future work.

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